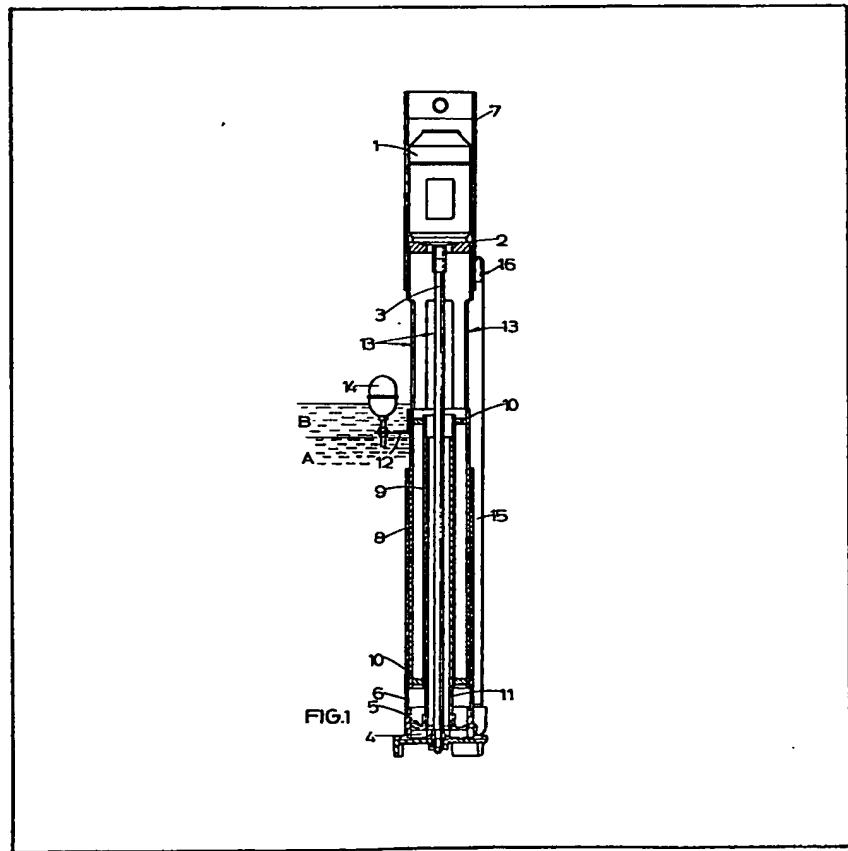


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(54) Submersible pumps for  
separating liquids

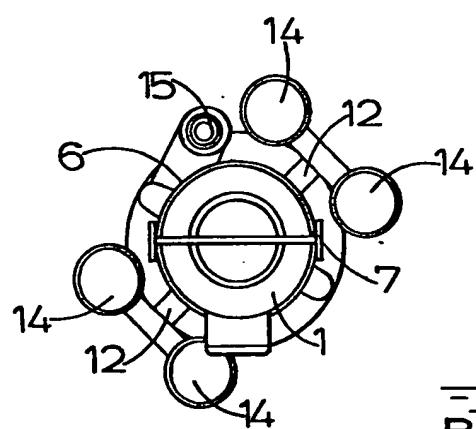
(57) In a combined motor-pump and intake assembly for separating two immiscible liquids such as oil and water by drawing off only the surface layer B, the motor 1 drives a submersible, centrifugal pump 5 through a downwardly extending vertical shaft 3. The inlet of the pump is connected to an upstanding intake pipe 11 concentric with the shaft and having a vertically movable, concentric, floating intake assembly 8, 9 slidable connected to the intake pipe to maintain the upper end of the tube 8 below the surface of only the liquid B. The outlet of the pump is connected to a pipe 15 extending upwards, outside (as shown) or inside a concentric casing 6 that connects the motor to the housing of the pump.



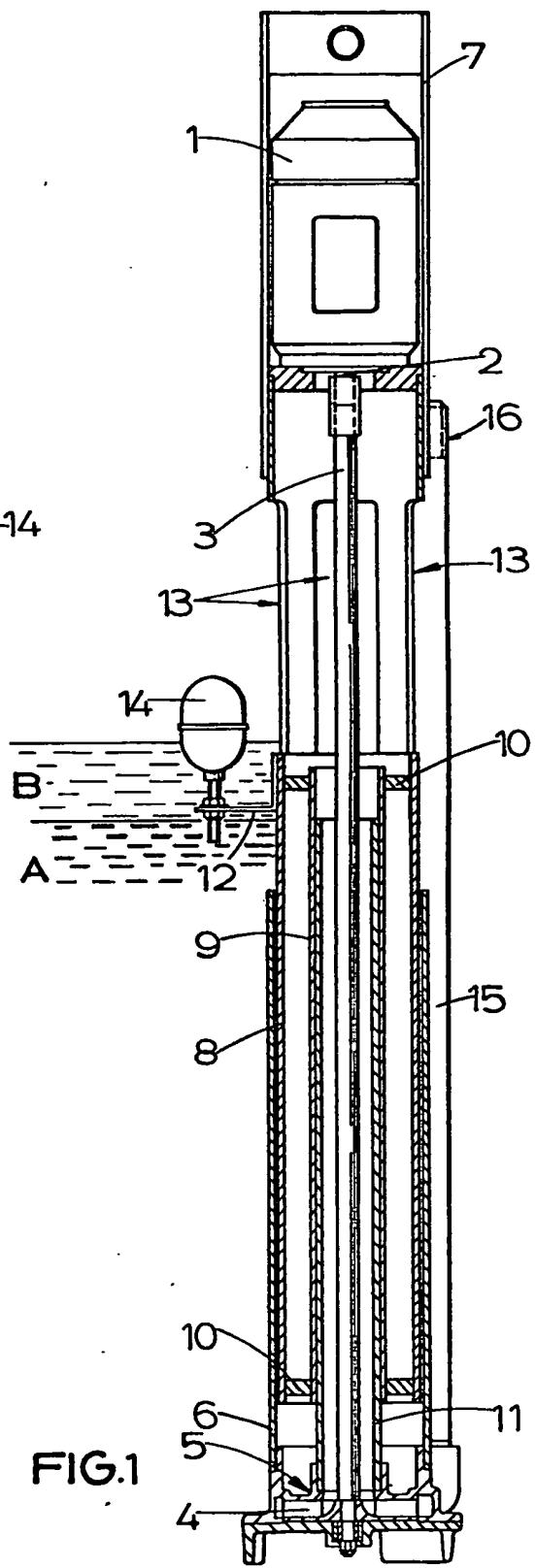
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**FIG.2**



**FIG.1**

**SPECIFICATION****Separating liquids**

- 5 This invention relates to apparatus for separating liquids, in particular oil and water-based liquids. The problem is a well-known one, for example where a water-based coolant used in machine shops becomes contaminated with oil and needs to be  
 10 cleaned and recycled. On a larger scale, oil spillage on the sea or on an inland stretch of water may need to be collected. As the oil will float on the water, it is known to provide some form of floating intake connected through a flexible pipe to a pump that will  
 15 draw off only the surface layer, i.e. the oil.
- Floating intakes of various forms have been proposed and have met with varying degrees of success. The aim of the present invention is to provide a novel assembly for separating a surface layer from a  
 20 body of liquid, more compact and economical in space than those known hitherto. According to the invention there is proposed a combined motor-pump unit and intake assembly comprising a top-mounted motor with a downwardly extending driving shaft connected at its lower end to the moving component of a pump supported from the motor, and a telescopic sleeve, coaxial with the driving shaft, making a substantially liquid-tight sliding or equivalent joint with an intake pipe leading to the  
 25 intake of the pump, whilst the upper end of the sleeve is provided with one or more intake openings and with flotation means so that the or each intake opening is kept close to the surface of a liquid in which the unit is partially immersed.  
 30
- 35 In this way we provide a compact complete assembly with a submersible pump, thus avoiding priming problems, and with a concentric variable-height floating intake that automatically adjusts itself to the level of the liquid surface. The flotation means  
 40 preferably comprise a float or floats, adjustable in height in relation to the intake opening or openings, or it could be in the form of an annular hollow liquid-tight collar immediately below the intake opening or openings.  
 45 The pump may be supported from the motor by a hollow casing concentric with the driving shaft. The delivery side of the pump may lead to a delivery pipe running up parallel to the casing. The pipe could pass through the casing, alongside the driving shaft,  
 50 to a connection above the liquid surface. In the latter case we eliminate altogether any external pipes, rigid or flexible, below the surface of the liquid.
- The invention will now be described by way of example with reference to the accompanying drawings, in which:
- 55 *Figure 1* is a diagrammatic side elevation, partly in section of an assembly according to the invention,
- Figure 2* is a plan view of an apparatus similar to that shown in *Figure 1* having various parts rotated  
 60 relative to their positions as shown in *Figure 1*.
- The unit comprises basically an electric motor 1 mounted vertically with its shaft 2 connected to a downwardly extending driving shaft 3 driving the impeller 4 of a centrifugal pump 5. The housing of  
 65 the pump is supported from the motor 1 by a hollow

steel tubular casing 6, concentric with the shaft 3. A yoke 7 attached to the upper end of the casing 6 and embracing the motor 1 provides means for suspending the whole unit with its lower part immersed in a mixture of liquids to be separated.

- 70 Sliding within the casing 6 is a floating intake assembly comprising outer and inner tubes 8 and 9 held together by top and bottom spacer rings 10. The outer tube 8 is a sliding fit inside the casing 6 and the inner tube 9 is a sliding fit on the outside of an upstanding concentric intake pipe 11 which leads directly to the eye of the impeller 4 of the pump. Brackets 12 around the outside of the upper end of the outer tube 8 project through slots 13 in the casing 6 and carry at least one vertically adjustable float 14 (four in the example shown) by which the upper end of the outer tube 8 is kept just below the surface of the top layer of liquid. The adjustment allows the assembly to be adapted to different densities of  
 80 liquid. The whole intake assembly is preferably made of plastics material, for example unplasticised PVC.

The outlet of the pump 5 is connected to a pipe 15 which passes vertically upwards parallel to the casing 6, terminating in a delivery connection 16 at the level of the upper end of the casing 6.

- 90 When the unit described is mounted with its lower part submerged in a liquid A that carries a second liquid B, immiscible with the first, floating on it, then provided the floats 14 have been set to a height to suit the different specific gravities of the two liquids, the intake assembly will float at such a level that the upper end of the outer tube 8 is below the surface of only the second liquid B and this condition will be  
 95 maintained even when the level of the interface between the liquids varies within reasonable limits. The second liquid B will pass down between the inner tube 9 and the shaft 3 to the intake of the pump and will be delivered by the pump through the pipe 15.  
 100 The separate circumferentially spaced floats 14 could be replaced by an annular flotation collar. In a further modification the delivery pipe 15, instead of being outside, could pass up inside the casing 6, leading to a lateral delivery connection through the wall of the casing 6 just below the motor 1.

105 The sliding joints between the intake assembly and the casing 6 could include packing, or an O-ring, or could take a different form altogether, for example being formed by flexible bellows. The invention is  
 110 also applicable to an arrangement where the electric motor 1 is replaced by some other source of power, and the pump could be of a form other than the centrifugal pump shown. The essential thing is the provision of a floating variable-height intake mounted concentrically around the vertical shaft that extends between a power source at the top and a pump at the bottom.

**CLAIMS**

1. A combined motor-pump unit and intake assembly comprising a top-mounted motor with a downwardly extending driving shaft connected at its lower end to the moving component of a pump supported from the motor, and a telescopic sleeve, coaxial with the driving shaft, making a substantially liquid-tight sliding or equivalent joint at its lower end
- 125

- with an intake pipe leading to the intake of the pump, whilst the upper end of the sleeve is provided with one or more intake openings and with flotation means so that the or each intake opening is kept
- 5 close to the surface of a liquid in which the unit is partially immersed.
2. An assembly according to claim 1 in which the flotation means comprise a float or floats, adjustable in height in relation to the intake opening or open-
- 10 ings.
3. An assembly according to claim 1 in which the flotation means comprise an annular hollow liquid-tight collar immediately below the intake opening or openings.
- 15 4. An assembly according to any preceding claim in which the pump is supported from the motor by a casing concentric with the shaft.
5. An assembly according to any preceding claim in which the delivery side of the pump leads to a
- 20 20 delivery pipe running upwards parallel to the intake pipe.
6. An assembly according to claim 5 as dependent on claim 4, in which the delivery pipe passes upwards within the casing, alongside the driving
- 25 shaft.
7. An assembly according to claim 4 or claim 6 in which the sleeve constitutes part of a floating intake assembly comprising inner and outer tubes, the outer being a sliding fit inside the casing and the
- 30 30 inner tube being a sliding fit on the outside of the intake pipe.
8. An assembly according to any one of claims 4, 6 and 7 in which brackets are provided around the outside of the upper end of the sleeve which project
- 35 35 through slots in the casing and carry the flotation means.
9. An assembly according to an preceding claim in which the sliding or equivalent joint is formed by flexible bellows.
- 40 10. An assembly according to any preceding claim in which the motor is an electric motor.
11. A combined motor-pump unit and intake assembly as hereinbefore described with reference to the accompanying drawings.